infinite set of equivalent points (in German: *regelmassiges Punktsystem*). Contrary to general opinion it is quite evident that Fedorov derived the space groups primarily by combining all possible symmetry elements in all possible ways, that is, in principle the same manner as Schoenflies, and not by space division.

In monograph 4, "Comparison of the crystallographic results of Schoenflies with mine," Fedorov showed complete coincidence of the number and types of his "regular systems of figures" with Schoenflies's "space groups," which is to be considered as a proof of the correctness of both derivations (1890–91). The last monograph, "A theory of the structure of crystals," deals with space partitioning into parallelohedra and stereohedra. As Fedorov pointed out later (1900) all space groups can be derived in this way, except 06-$P4_332$ and 07-$P4_12$ (compare my note in *Science* **174**, 52, 1971.) There are still some unsolved interesting problems in this field (see also the Introduction by D. Harker and my thesis "Homogene Raumteilung und Kristallstruktur", E. T. H. Zurich, 1935).

The project of this translation was sponsored by the National Science Foundation and the American Crystallographic Association Monograph Fund. All crystallographers not familiar with the Russian language must be extremely grateful to the translators and institutions that enabled the excellent production of this most important historical document, which may be still stimulating for modern scientists.

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Atomic-Absorption Spectrochemical Analysis

B. V. L'vov

324 pp. American Elsevier, New York, 1971. $43.00

This treatment of atomic absorption spectroscopy is an extremely readable yet comprehensive reference work on the theory, instrumentation, and application of the technique for chemical analysis. The wealth of experimental detail contained on its 324 pages will make it indispensible to any chemist who is concerned with inorganic analysis.

The book is an English-language edition of the Russian version published in 1965. It differs from its Russian counterpart in that many of the chapters have been revised and rewritten to reflect the new developments in the field. Treated are such topics as source lamps; the effects of filler gases and current on lamp emission, stability, and life; optics; modulation of beams; errors in measurements; atomization techniques; flames and burner designs; effects of solvents on the process and sensitivities. A separate chapter on the use of the graphite cuvette, which was developed by L'vov, makes many details on this important method available for the first time in English.

The chapter on special applications provides suggestions for further research in the vacuum-ultraviolet region and provides some data on the possibilities of isotope analysis.

The intriguing point of view presented by L'vov at the conclusion of the book is the prospect that it may be possible to achieve some analyses without the use of standards. He demonstrates the potential by calculating absolute oscillator strengths for some of the common metals using the graphite cuvette. With this approach many of the uncertainties in temperature gradients, effective sample path length, and sample-vapor inhomogeneity are reduced to tractable and calculable levels.

There are only two points of criticism that I would make of the book. The first is the price. It will necessarily limit its audience. The second is the impression that L'vov gives in advocating atomic absorption as the ideal approach for the analysis of ultrapure materials. The atomic-absorption approach, utilizing the graphite cuvette, is quite sensitive, but other companion techniques should also be used in establishing which impurities are to be examined. On the positive side, however, few techniques permit the sensitivities down to the 10^{-10} to 10^{-13}-gram level that appear to be possible with the graphite cuvette and a 3×10^{-14}-gram detection limit claimed for cadmium must indeed be a record.

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Relativity Reexamined

L. Brillouin

111 pp. Academic, New York, 1970. $6.75

In his book, *Relativity Reexamined*, Leon Brillouin attempts to find inconsistencies in Einstein's theories and to set up countertheories. Such programs are of value, particularly as a means to clarify one's understanding of the theories examined. Previous attempts in this direction have included scalar-tensor theory, Nordstrom's theory, Whitehead's theory, and so on.

In the course of discussing the experimental status of these theories, Brillouin provides clear and concise two- or three-page summaries of a wide range of topics in physics including long-baseline interferometry, initial conditions and the irreversibility of mechanics, the Mossbauer effect, and a discussion of length and frequency standards. Brillouin's book is short (110 pages), well written, and easy to understand, and the reader (even if he disagrees with Brillouin) should have little difficulty in understanding what point the author is making.

In his reexamination of special relativity, Brillouin reformulates the theory but obtains results essentially in agreement with Einstein's—although his interpretation differs somewhat. He discusses the inability of special relativity to describe gravitational effects correctly. This unsatisfactory situation led Einstein and others to search for what was to become the general theory of relativity. In particular Brillouin notes that, in special relativity, "one completely ignores any possibility of mass connected with external potential energy . . . . We are thus in a strange situation, where internal potential energy obtains a mass, while external potential energy does not." He notes that general relativity and the scalar-tensor theory are not plagued with this difficulty. Thus, Einstein was successful in circumventing the problem.

Like many physicists, Brillouin is interested in combining relativity and quantum mechanics into one consistent theory. He suggests that this can be accomplished by incorporating into classical physics Einstein's mass-energy relation, Max Planck's energy-frequency relation, and Niels Bohr's condition on stable energy levels. But he does not say how to carry out his program.

Brillouin feels that general relativity has many flaws, and to correct them he continues his examination of interaction energy and obtains an expression for the gravitational field energy by analogy with electromagnetic theory. Adding the gravitational field energy to the energy density of matter in Newtonian theory, Brillouin obtains a nonlinear gravitational theory. Despite the difference in approach, Brillouin's theory gives an equation very similar, but not identical to, Einstein's $R_0^0=0$ equation for the case he considers.

The stage to which Brillouin was able to carry his work before his death leaves many questions unanswered. It was shown neither how this theory could be used to treat dynamical situations, nor how the theory could be critically compared with experiment.

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Science Restated, Physics and Chemistry for the Non-Scientist

H. G. Cassidy
526 pp. Freeman-Cooper, San Francisco, 1970. $8.75

The teaching of elementary college physics has always provided a challenging problem to the thoughtful and enterprising instructor. In recent years the basic course for nonscience majors in particular has attracted increasing attention and has led to numerous ventures, many of them embodied in more or less attractive textbooks. The present volume, by the well known professor of chemistry at Yale University, is an addition to the ever-growing list. It is based on a course with which the author and numerous colleagues have experimented during the past dozen years in the endeavor to convince the so-called arts student that there is something worthwhile in grasping the meaning of physical science as a part of human culture. From the long-standing concern of the author with the relation between science and the humanities and the problems of science and society as well as his enthusiasm for teaching, he would appear to be well qualified to undertake such an experiment.

The preface emphasizes that the appeal of the text is to the individual student, to try to make him literate in science so that he may successfully connect the world of experience with the world of constructs constituting the science of physics. The author bases his approach largely on Margenau's view of the nature of physical reality, with its stress on the P plane of experience and the C field of constructs. The order and arrangement of topics are deliberately unconventional. The preliminary treatment of mechanics is very sketchy, being limited entirely to kinematics, from which the text proceeds directly to electricity and magnetism. Here the author picks up further mechanical ideas as they appear to be necessary for an understanding of the phenomena. Light comes next, leading on to relativity, electromagnetic radiation and quantum theory. The longest section in the book (168 pages) is devoted to the atomic concept, with attention to nuclear physics, chemistry, and so on.